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Trade Liberalization in International Dairy Markets

Estimated Impacts

Suchada Langley, Agapi Somwaru, and Mary Anne Normile

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Abstract

A partial-equilibrium, multiple-commodity, multiregion model of agricultural policy and trade is used to simulate the effects of changes in domestic and trade policy on dairy production, consumption, prices, and trade. Simulations using the ERS-Penn State Trade model analyze the effects of separately and concurrently relaxing domestic income and price supports, and import restrictions and export subsidies, with special attention to tariff-rate and milk production quotas. Modeling results indicate that liberalization would reduce world dairy product supplies and increase the value of dairy trade.

Keywords: Dairy markets, dairy policy, trade models, global liberalization.

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Contents

Preface

This report is the first of two articles on international dairy markets. The reports examine the forces that currently are shaping international dairy markets and those that are anticipated to substantially affect the sector in the next several years. These forces include changing consumer demand in developing and developed economies; technological advances in production, distribution, and marketing; product innovation; globalization; and the possibility of fundamental dairy policy reform brought about through multilateral trade negotiations. The reports follow from ERS's earlier research on the domestic dairy market, *Economic Effects of U.S. Dairy Policy and Alternative Approaches to Milk Pricing*.

The first report, *Trade Liberalization in International Dairy Markets: Estimated Impacts,* presents an economic model-based examination of the effects of global dairy policy reform on international dairy markets. A partial-equilibrium, multiple-commodity, multiregion model of agricultural policy and trade is used to simulate the effects of changes in domestic and trade policy on dairy production, consumption, prices, and trade.

The second report, *U.S. Dairy at a Crossroad*, presents a synthesis of analyses on the major factors influencing global dairy markets. This report provides a comprehensive picture of the international dairy market in the post-Uruguay Round era, detailing trends in world dairy production and trade, emerging trends in demand and technology, globalization and new developments in foreign investment, and the interface of dairy policies and trade. The effects of changes in dairy policy are placed in this broader context, where the industry's ability to respond and adapt to changing market environments provides a more comprehensive perspective on the results of potential dairy policy reform.

Summary

The ongoing debate over agricultural trade liberalization focuses on how best to eliminate policy distortions that arise from price supports, producer subsidies, import protection, and export subsidies. Price support measures include government purchase programs, intervention purchasing and storage, and supply management, including production quotas. This report examines how international dairy markets might respond to policy changes under various reform scenarios. Specific policy scenarios include reductions in tariffs, markups, loan rates, intervention prices, export subsidies, and expanding tariff-rate quota minimum access, as well as elimination of production quotas and consumer subsidies. By examining policies separately, we can better understand each policy's economic impact and how alternative reforms might affect world dairy markets.

What Is the Issue?

Despite policy reforms enacted as a result of the Uruguay Round Agreement on Agriculture, global dairy markets remain among the most protected agricultural sectors. Dairy trade is characterized by "megatariffs" (tariffs usually over 100 percent), tariff-rate quotas (tariff rate depends on the volume of imports), and export subsidies. In addition, many countries provide trade-distorting income and price support to the dairy sector. As a result, much of the world trade in dairy products is driven more by policy intervention than by market factors.

Support to dairy producers makes up a large share of some countries' aggregate domestic support for all commodities (on average, since 1995, 100 percent for Australia, 84 percent for Canada, 55 percent for the United States, and 12 percent for the EU). How might the removal of such support affect countries' relative competitiveness in international dairy markets? Would consumers worldwide pay more or less for milk and dairy products? And how would the U.S. dairy industry fare in a more liberalized environment?

What Did We Find?

International dairy policy reform would result in lower global supplies of milk and dairy products, higher world dairy prices, and higher value of dairy trade. By eliminating policies that artificially increase returns to milk production, the volume of global milk and dairy products declines. With less production, global prices increase. The production decline is small, despite large reductions in support prices and production-linked subsidies, because the contracting effect of lower support is tempered by the expansionary effect of eliminating production quotas in the EU and Canada.

Production of dairy products generally moves in the same direction as milk production in each country, with some exceptions. For example, while U.S. production of raw milk, butter, nonfat dry milk, whole dry milk, and other dairy products declines, cheese output expands slightly because the value of milk in cheese production is higher than its value in the production of other dairy products.

Dairy policy liberalization was found to affect countries differently:

- Countries with high levels of support and protection (e.g., Japan and Korea) generally lose production value when support and protection are eliminated.
- Countries producing dairy products at lower cost and those with low support and protection (e.g., Australia and New Zealand) gain the most from trade liberalization, as their producers benefit from higher world market prices and their exports grow.
- The effect on countries with moderate support and protection-like the United States, the EU, and Canada-depends on the policy mix in each country. The effect of domestic price declines on production in the EU and Canada is offset by the expansionary effect of removing production quotas. In the United States, the elimination of support contributes to a decline in milk price and production. However, a continuation of 1-percent productivity growth in milk production per year would offset any losses to U.S. milk producers.

Liberalization of dairy policies changes countries' shares of the global market. The EU, currently the world's largest exporter of dairy products, sees its share of world butter and nonfat dry milk exports decline, but maintains its share of the cheese market. Like the United States, EU milk realizes a higher return in production of cheese than butter and nonfat dry milk. New Zealand's and Australia's shares of butter and nonfat dry milk exports rise, but Australia's share of other dairy products falls. Argentina grows in all markets except other dairy products. The United States maintains its position in most markets, gaining slightly in the nonfat dairy market.

How Was the Study Conducted?

Scenario analyses were conducted using the ERS-Penn State Trade model, a partial-equilibrium, multiple-commodity, multiregion model of agricultural policy and trade that simulates impacts of policy changes on world markets and trade. The model has a detailed representation of the dairy sector and of policies affecting production, consumption, and trade of milk and dairy products.

Specification of individual policy instruments in the model allowed the impact of individual reforms to be examined separately and simultaneously in order to evaluate which policy interventions most influence dairy prices and trade. Two important policies for the dairy sector—tariff-rate quotas and production quotas—are modeled explicitly. Liberalization of all agricultural policies illustrates the effect on the dairy market of dairy-related commodities, such as feed grains and other livestock.

Trade Liberalization in International Dairy Markets: Estimated Impacts

Suchada Langley, Agapi Somwaru,
and Mary Anne Normile

Introduction

International dairy markets are highly protected. Under the World Trade Organization's Uruguay Round Agreement on Agriculture, members agreed to reduce trade-distorting domestic support, import barriers, and export subsidies. However, the Agriculture Agreement did not require members to reduce domestic support to individual agricultural commodities. Many members left dairy support largely untouched and reduced support to other commodities. Under the Agriculture Agreement's market access provisions, members agreed to replace nontariff barriers like quotas and prohibitive levies with equivalent protection in the form of tariffs (a process called "tariffication"), and to reduce those tariffs. But many members chose to reduce tariffs by the minimal 15 percent, so that countries with the highest protection before the Agriculture Agreement maintain high tariffs. A USDA study found that, in most regions, tariffs on dairy products are well above the average agricultural tariff and among the highest of all commodities (Gibson et al., 2001). The Agriculture Agreement also required countries to reduce agricultural quantities exported with subsidies and to reduce the expenditures on those subsidies. Export subsidy disciplines were applied to individual commodities, and so were more successful in reducing dairy subsidies than were domestic support and market access disciplines.

The ongoing debate on agricultural trade liberalization focuses on how to establish a more market-oriented trading system through further reforms in domestic support, market access, and export subsidies. This report examines how international dairy markets might respond to policy changes under various scenarios. Scenarios are constructed to isolate potential impacts of individual domestic and trade policies and to examine their influence collectively. By examining the consequences of separate policies we can better understand each policy's economic impact and how alternative trade reforms affect world dairy markets. A partial-equilibrium, multiple-commodity, multiregion model of agricultural policy and trade is used to simulate the effects of changes in domestic and trade policy on dairy production, consumption, prices, and trade.

The scenario analyses do not consider other factors currently affecting dairy markets such as the rapid economic growth in emerging markets, product innovation, and restructuring in global dairy markets. The scenario analyses are not intended to be a forecast or projection of future policy change.

Dairy Policies and Key Issues Affecting Trade

The major dairy policies for most countries[1] include income and price support, import restrictions, and export subsidies. A few countries also use consumer subsidies to dispose of surpluses or increase demand for dairy products. Support to dairy producers makes up a large share of some countries' aggregate domestic support for all commodities (on average, since 1995, 100 percent for Australia, 84 percent for Canada, 55 percent for the United States, and 12 percent for the EU). In the United States, income support for dairy producers includes direct payments and, in the recent past, *ad hoc* disaster assistance. Price support measures include government purchase programs (U.S.), intervention purchasing and storage (EU), and supply management through production or marketing quotas (EU and Canada). (Appendix A provides an overview of the main dairy programs of major countries). If further reductions in domestic support are negotiated in the Doha Round, countries will likely be pressured to reduce support to the dairy industry.

Most major dairy trading countries maintain tariff-rate quotas (TRQ) for dairy products. TRQs were instituted to maintain and expand imports, as they were designed either to keep the same level of import access as before tariffication under the Agriculture Agreement (current access) or to ensure that there was some increase in access after tariffication (minimum access), or both. TRQs operate as two-tier tariffs that combine both tariffs and quotas (Skully, 2001). A relatively low tariff applied to a fixed quantity of imports is coupled with higher tariffs for imports above that quantity. With minimum-access TRQs, access to previously protected dairy markets expanded under the Agriculture Agreement. However, import access for some countries fell below intended levels because fluid milk and some other fresh dairy products generally were excluded from required minimum-access levels. These excluded products account for sizable shares of total consumption in some cases.

Prior to and under the Agriculture Agreement, many of the dairy products exported from the EU, other Western European countries, and Canada were subsidized. The United States also exported most nonfat dry milk (NFDM) and some cheese, whole-milk powder, and butter with subsidies through the Dairy Export Incentive Program (DEIP). Even Australia and some Eastern European countries, countries not usually associated with export subsidy programs, have used export subsidies for dairy products.

Although export subsidies were reduced under the Agriculture Agreement, they continue to distort international dairy markets. Between 1995 and 2000, an estimated third to a half of cheese, butter, and dry milk exports continued to be subsidized.

Production or marketing quotas are used as a supply management tool in Canada and the EU to control milk surplus and to limit government expenditures on dairy products. Because milk production quotas are usually used in tandem with other policy instruments such as price support and import restrictions, they also slow liberalization of world dairy policies.

[1]This study focuses on countries that are important from the perspective of dairy policy (European Union, United States, Canada, Japan, and South Korea) or major participants in international dairy markets (Australia, New Zealand, Argentina, and Brazil).

Some issues not explicitly addressed in the Agriculture Agreement, like revenue pooling and domestic price differentials, also affect dairy product markets. Revenue pooling allows revenue from higher priced domestic sales to subsidize lower priced sales to export markets.[2] Domestic price differentials that provide a price premium for fluid milk can depress consumption of milk for fluid use and increase the supply of milk for nonfluid uses. This leads to artificially low prices for manufactured dairy products, which discourages imports and makes it easier to export.

[2]A WTO dispute panel found that revenue pooling constituted an export subsidy.

Key Issues in Modeling Dairy Policies

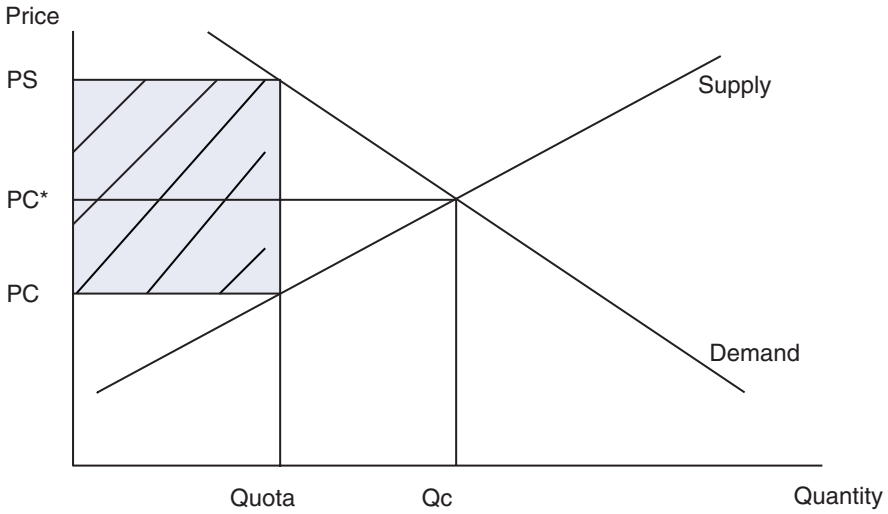
There are at least two challenges in modeling dairy trade policy: the modeling of milk supply in the presence of milk production quotas and the implementation of TRQs. With milk production quotas, modeling difficulties stem from the fact that countries implement quotas differently and there may be insufficient data for quantitative analysis of supply response. TRQs, implemented as two-tiered tariffs, introduce discontinuities that complicate standard modeling techniques.

A production (or marketing) quota is a license to sell a limited quantity of milk at the supported price. In countries like Canada, where milk quotas can be bought and sold freely, the annual value of the quota rent is capitalized into the value of dairy quotas. Quota rent is the discounted sum of the future stream of net benefits to producers as a result of holding the quota. The key question for modeling dairy policy reform is how a supply-managed dairy sector would respond if milk production quotas were removed. Without recent historical evidence of milk supply response in countries that operate milk production quotas, such an assessment is difficult. Different countries operate different milk production quota systems, which further complicates modeling. One way of addressing the problem is to assume a position of the supply curve and employ sensitivity analysis on the supply elasticity with respect to the removal of production quotas.

Figure 1 illustrates the effects on the domestic market of eliminating a milk production quota. At production level "quota," a maximum level of milk production (or milk sales) is set by the government. This implies the price to the producer would be PS, with the shaded area "quota rent" representing the value of the quotas to producers. With a removal of the quota, milk production increases toward Qc and producer price received for milk declines toward PC* as the quota rent falls to zero. If there are no other

Figure 1

Effect of a milk production quota on the domestic market



Source: Economic Research Service, USDA.

policies affecting the producer price (like a support price or tariff), the corresponding price and quantity would be PC* and Qc.

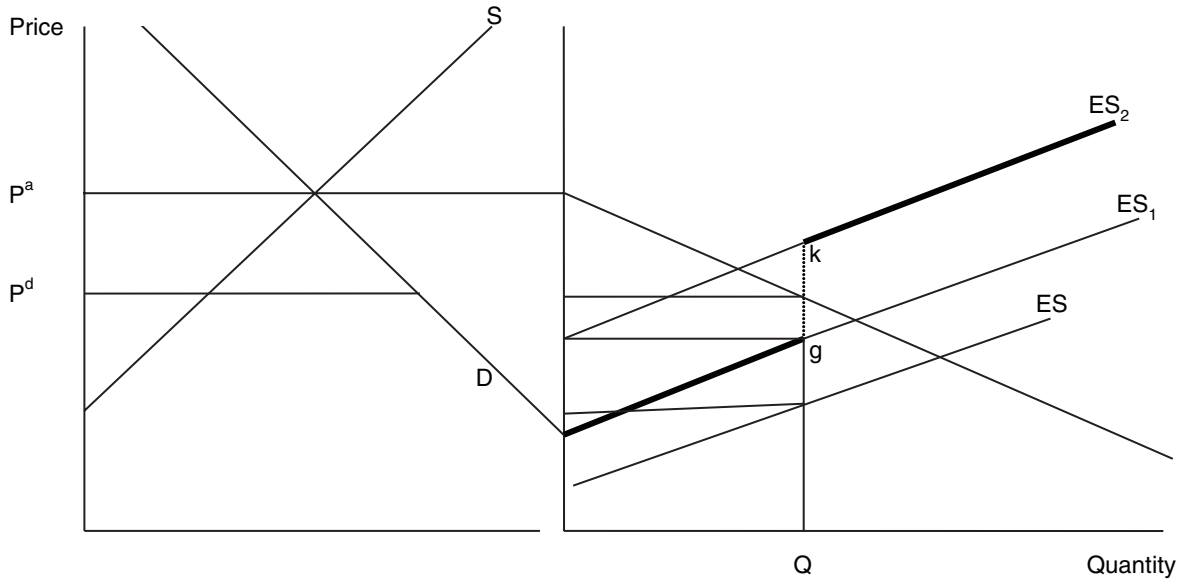
Figure 2 illustrates the difficulties in modeling tariff-rate quotas. The left panel represents the domestic market for an importing country with domestic price at P^a (autarky price). *Excess* demand and supply curves are on the right panel. Levels of imports, where excess demand intersects excess supply, depend on the slopes (elasticities) of *excess* demand and excess supply curves as well as the location of *excess* supply curves. ES represents *excess* supply with no tariff applied, ES_1 with in-quota tariffs , and ES_2 with over-quota tariffs. Where the discontinuity occurs between ES_1 and ES_2 (the distance "kg"), the TRQ quota level, Q, is binding. At the excess supply ES_1, *excess* demand ED, and TRQ quota Q, the equilibrium domestic price is P^d. This condition is equivalent to a pure quota, where quota is set at Q. In reality, we may not know precisely where the excess supply curve is located.

TRQs pose modeling challenges because of the inequality conditions set by tariff-rate quotas and the discontinuity of the level of excess supply. The effective supply curve of exports to import markets under TRQs is discontinuous. Import quantity and tariff rates under a TRQ regime can be captured in the form of an inequality and the use of the so-called complementarity condition. Under a complementarity condition, either an equation is true or its complementary variable is at a boundary value (Dirkse and Ferris, 1995, 1997, 1999). That is, if imports are greater than the quota, then imports face the high tariff (complementary variable); if imports are less than the quota, then the relevant tariff is the in-quota tariff.

Further complicating analysis of TRQs is how they are implemented. Each country implements them differently. For a variety of reasons, access quotas do not guarantee that countries will import or quotas will be filled (Wainio et al.,

Figure 2

Effects of a tariff-rate quota



Source: Morath, Todd and Ian Sheldon, "The Economics of Modeling Tariff-Rate Quotas," Figure 1, *http://trade.aers.psu.edu/documentation.cfm*

1998). They are simply requirements that countries provide opportunities for imports by reducing tariffs on a fixed quantity of product. In addition, tariff bindings for TRQs are maximum tariffs—applied tariffs may be lower. Finally, the assumption that products are homogeneous may be problematic for products like cheese, where product differentiation and niche markets play a big role in consumption and trade.

Various studies analyze milk production quotas and TRQs differently. Comprehensive studies of world dairy trade liberalization are limited. Shaw and Love (2001), using the Organization of Economic Cooperation and Development (OECD)'s Aglink model, a partial-equilibrium dynamic supply-demand model of world agriculture, examined the economic effects of increasing market access and reducing export subsidies for dairy products and found that the value of world dairy trade increased substantially. The model treats milk production quotas exogenously. Relative to a 1999 baseline, the study estimates that the value of world dairy trade rises by $1.8 billion under increased market access, with the value of milk production rising in Australia, New Zealand, and Argentina (7-9 percent over the base), and declining in the EU and the United States (1.2-1.4 percent). With export subsidies reduced by half, the value of milk production also increases in Australia, New Zealand, and Argentina; declines in the EU; and remains constant in the United States.

Cox et al. (1999) used a hedonic spatial equilibrium analysis of dairy trade liberalization for 21 world dairy regions, and found that full trade liberalization has sizable impacts on milk prices in Canada (-32 percent), the EU (-26 percent), Japan (-36 percent), Australia (22 percent), and New Zealand (51 percent). U.S. milk producers saw only small changes in milk prices (-0.4 percent) and production. Cox et al. estimate consumer surplus to be $10 billion higher under a free trade scenario. The study does not include reductions in domestic support in its liberalization scenario, nor does it model other commodities. Milk production quotas are exogenous.

OECD Secretariat (2004), using its Aglink model, examined the effects of simultaneously reducing or removing market price support policy measures to assess the impact of dairy trade liberalization on production, consumption, trade, prices, and welfare. The study addressed the uncertainty regarding the supply response in countries with quotas by conducting a sensitivity analysis on the quota rent and supply elasticity assumptions. OECD found that prices on world dairy markets increased significantly with dairy trade liberalization—increases in the price of dairy products ranged from 17 percent for whole-milk powder to 57 percent for butter—while global milk production declined slightly (-0.2 percent). Trade expanded in cheese (25 percent) and nonfat dry milk (5 percent), and contracted for butter (-1.3 percent) and whole-milk powder (-3 percent). Trade liberalization resulted in production shifting to more efficient countries. Milk production fell in Japan (-19 percent), the EU (-7 percent), the United States (-5 percent), and Canada (-1 percent), and expanded in Australia and Argentina (14 percent each) and New Zealand and Brazil (10 percent each).

A number of studies analyze the effects of dairy trade policy reforms on individual countries (Doyon and Novakovic (1996), Bouamra-Mechemache and Requillart (2000), Van Bekkum et al. (2000), and Lariviere and Meilke (1999)).

ERS-Penn State Trade Model

This study uses the ERS-Penn State Trade model to examine the effects of key policy changes and trade liberalization on international dairy markets. The ERS-Penn State Trade model is an applied partial-equilibrium, multiple-commodity, multiregion model of agricultural policy and trade (Abler et al., 2001; Stout and Abler, 2004). It is a gross trade model that accounts for exports and imports of each commodity in every identified region. The model does not identify bilateral trade flows.

The model includes 12 countries/regions--the United States, the European Union (EU-15), Japan, Argentina, Australia, Brazil, Canada, China, Mexico, New Zealand, South Korea, and the rest of the world (ROW). It has 35 commodities (rice, wheat, corn, other coarse grains, soybeans, sunseed, rapeseed, peanuts, other oilseeds, cotton, sugar, soybean oil and meal, sunseed oil and meal, rapeseed oil and meal, cottonseed oil and meal, peanut oil and meal, tropical oils, other oilseed oil, beef and veal, pork, poultry, raw milk, butter, cheese, nonfat dry milk, whole dry milk, fluid milk, and other dairy products).[3] All commodities are treated as tradeable except raw and fluid milk.[4]

The model is a reduced-form model with production, consumption, and other behavioral equations specified by constant-elasticity functions. All countries in the model have a similar structure, with different parameters and variable values in the behavioral equations. Imports and exports are determined as residuals.

The base year for dairy data is 2001. Base data for crops (area, yield, production, consumption, stocks, and trade) are from the 2000 crop year and are drawn from USDA and country sources, including the USDA production, supply, and demand (PS&D) database. Tariffs and TRQs are from the Agricultural Market Access Database (AMAD) and Gibson et al. (2001).

Parameters in the model come from various sources, including the European Simulation Model (ESIM) (Josling et al., 1998), ERS baseline model projections (USDA, ERS, 2005), the Food and Agricultural Policy Simulator (FAPSIM) (Gadsen et al., 1982), OECD's Aglink model (Conforti and Londero, 2001), and the SWOPSIM (Static World Policy Simulation) model (USDA, ERS, 1991). Adjustments and restrictions are imposed on elasticities to satisfy theoretical requirements such as symmetry and homogeneity in output supply equations, food/consumer demand equations, feed demand equations, and harvested acreage equations. For detailed information on the model structure, equations, sources, and methods, see Stout and Abler (2004).

The core set of policies for all countries includes both specific and *ad valorem* import and export taxes/subsidies, tariff-rate quotas (TRQs), and producer and consumer subsidies (table 1). The U.S. component of the model includes government purchase prices, tariffs and TRQs, and Milk Income Loss Contract (MILC) payments. Compensation schemes for Japan and South Korea that pay producers for declines in price relative to a reference price are also included. The EU component includes intervention prices (which entail government purchases and export subsidies),

[3]Constraints on dairy product shares are imposed to preserve consistency of milk components.

[4]We adjust the core model by treating "other dairy products" as tradable. Other dairy products, like ice cream, yogurt, and whey, are traded, a more realistic reflection of actual markets.. This assumption allows greater flexibility in product and trade flows.

Table 1
Dairy policies reformed in trade liberalization scenarios, by country and product

Country	Milk	Butter	Cheese	Nonfat dry milk	Whole dry milk	Other dairy products
US	PS,PP	T,TQ,X,PS	T,TQ,X,PS	T,TQ,X,PS	T,TQ,X	
EU	PS,Q	T,TQ,X,PS,C	T,TQ,X	T,TQ,X,PS	T,TQ,X	T,TQ,X
Japan	PP	T,TQ	T	T,TQ		
Canada	PS,Q	T,TQ,X	T,TQ,X	T,TQ,X	T,TQ,X	T,TQ,X
Mexico		T	T,TQ	T,TQ	T,TQ	
Brazil		T	T	T	T	
Argentina		T	T	T	T	
China				T	T	
Australia		T	T,TQ	T	T	
New Zealand		T	T	T	T	
South Korea			T	T,TQ		
Rest of world		T	T	T	T	T

T = Tariffs
TQ = TRQs
X = Export subsidies
PS = Price support
PP = Producer payments
Q = Production/marketing quota
C = Consumer subsidies.

Source: Stout and Abler, 2004; ERS

tariffs, compensatory payments, acreage set-asides, base area bounds (which limit the area of grains and oilseeds that qualifies for payments), and production quotas for raw milk and sugar.[5] Milk production quotas for Canada are also included.

[5]The model does not include limits on countries' exports due to WTO export subsidy commitments

The model can be used for comparative static analysis or for dynamic analyses. We use the model as comparative static analysis with an adjustment path, implying a medium-term supply response. The analysis does not account for shifts in supply functions over time, reflecting cost-reducing technology adoption. No productivity growth is taken into account. This point is crucial in interpreting the model results. For example, productivity growth, if incorporated into the analysis, would show that a country with a capital-intensive and technologically advanced dairy sector that is able to compete in a nonsupported and nonprotected environment (such as the United States) may do well under trade liberalization.

We model two key policy issues—TRQs and production quotas—explicitly, taking into consideration the discontinuities described in figures 1 and 2. For both TRQs and EU/Canadian milk production subject to a production quota, we make use of the complementarity condition as the relevant functions exhibit discontinuity.

Model Limitations

Despite our attempts to deal with key policy issues in the model and to try to replicate world dairy markets as closely as possible, the model has limitations. The ERS-Penn State Trade model uses 2000/2001 as a base period. We have adjusted the base for some major policy changes, such as the commodity provisions of the 2002 Farm Bill and China's accession to the

WTO. Other recent policy changes, which may affect dairy markets, have not been incorporated. This includes the expansion of the European Union from EU-15 to EU-25 and the recent CAP reform. The EU dairy program changes were not agreed to until 2003 and are being implemented in 2004-07. The dairy reform reduced intervention prices for butter and nonfat dry milk by 25 percent and 15 percent, and provide direct payments to dairy producers to be phased in over the same time period.[6]

The analysis also does not include increases in demand driven by population and income growth and post-2000 exchange rate movements. Rather, these factors are considered as exogenous variables in the model. The decline in the U.S. dollar relative to other currencies would suggest that the U.S. dairy sector would be more competitive than the results reported in our scenarios.

Finally, not every aspect of policy implementations can be modeled precisely. Some simplifications are necessary in order to have a consistent set of policy instruments in the model. For example, the model does not include fluid milk domestic marketing programs.

[6]The effects on the model results of incorporating EU CAP reform can be assessed qualitatively. Cutting intervention prices (thereby lowering producer raw milk prices) means that the difference between the EU internal price and the world market price is smaller. With trade liberalization, removing a smaller distortion yields smaller impacts in terms of EU production, prices, and trade. With other things equal, incorporating CAP reform into the model would yield smaller changes in world dairy prices and trade and smaller impacts on dairy producing and consuming countries.

Dairy Trade Liberalization Scenarios

This report examines how international dairy markets might respond to policy changes under various assumptions of policy reform. We analyze five scenarios (table 2). The purpose of the first three scenarios is to illustrate the economic effects of individual policies. Scenarios 1-3 decompose policy impacts by eliminating each type of intervention separately. In scenario 1, all restrictions on milk production (production quotas) are removed; in scenario 2, all tariffs and TRQs are eliminated; and in scenario 3, domestic support—price supports (intervention prices, loan rates, other support prices, government purchases) and producer payments—are eliminated. The attempt to measure the separate impact of each policy is not meant to imply that it would be possible for a government to operate each of these policies in isolation. Scenario 4 removes all dairy policies simultaneously for all countries/regions. Scenario 5 goes one step further by removing all agricultural policies simultaneously to illustrate the effects of cross-commodity policy on dairy markets. Key to the results of this scenario is the competitiveness of countries' feed sectors. The scenario analysis is not intended to be a forecast or projection of future policy change.

Table 2
Summary of policy instruments liberalized in each scenario

	Scenario 1 Quota abolition	**Scenario 2** Tariffs and TRQs eliminated	**Scenario 3** Domestic support eliminated	**Scenario 4** Dairy-only liberalization	**Scenario 5** All commodities liberalized
Q	No milk production quotas	Policy unchanged	Policy unchanged	No milk production quotas	No milk production quotas
T, TQ	Policy unchanged	Tariffs and tariff-rate quotas eliminated	Policy unchanged	Tariffs and quota tariffs eliminated	Tariffs and quota tariffs eliminated
PS, PP	Policy unchanged	Policy unchanged	Domestic price support and producer payments eliminated	Domestic price support and producer payments eliminated	Domestic price support and producer payments eliminated
X, C	Policy unchanged	Policy unchanged	Policy unchanged (export subsidies not required when price support eliminated)	No export and consumer subsidies	No export and consumer subsidies

T = Tariffs.

TQ = TRQs.

X = Export subsidies.

PS = Price support.

PP = Producer payments.

Q = Production/marketing quota.

C = Consumer subsidies

Scenario Results

The findings of the five scenarios are discussed below and summarized in tables 3-8.

Scenario 1: Removal of Milk Production Quota

Removing milk production quotas in Canada and the EU results in higher milk production—0.1 percent higher in Canada and 4 percent higher in the EU (table 3)—and lower producer prices for milk in both countries/regions. Smaller milk production effects in Canada reflect the fact that Canada sets its milk quota production near the estimated market demand and supply levels for milk. Quotas are adjusted frequently as demand and supply change. For the EU, higher milk production also means greater milk availability for dairy products. EU's net dairy exports for butter, cheese, nonfat dry milk, and whole dry milk increase. With the increase in supply from the EU, world prices of dairy products decline. As a result, net dairy exporters such as Australia and New Zealand, who receive the world market price, lose revenue as both milk price and production declines. The effect on the U.S. dairy sector is relatively small, as the U.S. share of world dairy markets is just 4 percent (in milk equivalents) (Dairy Australia, 2004).

The magnitude of effect from removing production quotas depends on the position of the supply curves and milk supply response elasticities in both the EU and Canada. For example, with higher (lower) elasticities, removal of the quota results in greater (lesser) milk production responses. Higher supply response implies that the cost of adjusting milk production is low and producers can easily increase milk production with the removal of the quotas. We begin with the premise that the EU's cost of milk production is high, supply response is limited, and the effect on prices of quota removal is larger (-9 percent) than the effect on production (+4 percent). Therefore, quota removal results in higher net trade levels (than the base year) with larger price changes. If a larger supply elasticity is assumed, removing milk

Table 3
Effects of eliminating milk production quota in EU, Canada

Country	Milk producer price	World price dairy			Milk production	Quantity imports/exports in key markets					
						Exports			Imports		
		Butter	Cheese	Nonfat		Butter	Cheese	Nonfat	Butter	Cheese	Nonfat
					Percent change						
US	-0.3	-7.0	-9.7	-4.0	-0.1		-19.0	-5.4			
EU	-8.7	-7.0	-9.7	-4.0	4.1	-22.0	14.5	5.4	-79.2	-79.4	-79.5
Japan	-0.4	-7.0	-9.7	-4.0	-0.1					4.4	1.8
Canada	-6.3	-7.0	-9.7	-4.0	0.1						
Mexico	-4.3	-7.0	-9.7	-4.0	-1.1						
Brazil	-5.5	-7.0	-9.7	-4.0	-1.4				7.1	176.0	2.3
Argentina	-6.1	-7.0	-9.7	-4.0	-1.5	-16.7	-50.0	-11.1			
Australia	-6.4	-7.0	-9.7	-4.0	-1.6	-2.0	-4.9	-2.0		2.5	
New Zealand	-7.7	-7.0	-9.7	-4.0	-2.0	0.3	-7.1	0.6			
South Korea	-2.2	-7.0	-9.7	-4.0	-0.6		5.0				
Rest of world	-4.7	-7.0	-9.7	-4.0	-1.2	-4.0	-4.2	-1.3	12.6	14.5	14.9

production quotas in the EU could increase milk production more than in the current scenario. With an increase in supply elasticity from 0.35 to 0.45, milk production would be an estimated 20 percent higher.

In Canada, milk production quotas are tradable and their value has been incorporated into milk production decisionmaking. Milk quotas have created a milk price premium (rent), and removing them would imply a lower consumer milk price (6.3 percent lower from the base year) (table 3). We have assumed that price support remains unchanged and that Canada adjusts milk production quotas to maintain domestic balance in the dairy market. Therefore, the effects on milk production of removing production quotas would be smaller than in the EU.

With all other policies remaining in place, higher milk production could translate into either higher inventories or higher exports. Since the model does not capture inventories, the simulation results show higher net exports of dairy products, exports that are not restricted by limits on dairy exports imposed by countries' WTO commitments (for this simulation). Consequently, increased production in the EU and Canada increases net exports of dairy products. In reality, when EU support prices are above world market prices, subsidies would be required to export dairy products, and the WTO commitments of EU members would limit their ability to increase exports. Export subsidy constraints would thus insulate the world market from much of the impact of increased EU production. The increased production would have to be consumed or accumulated as stocks in the EU.

Scenario 2: Removal of Import Restrictions

In this scenario, all tariffs and tariff-rate quotes are eliminated. Average tariffs on dairy products are particularly high in Japan (323 percent), Canada (220 percent), the EU (85 percent), and Korea (72 percent), while the average U.S. tariff on dairy products is 43 percent (Gibson et al., 2001). Removal of tariffs, tariff-rate quotas, and other import restrictions lowers milk producer prices in importing countries, ranging from 7 percent (Japan) to 48 percent (Korea) (table 4). Milk production in Canada and the EU declines by about 3 percent, and in the United States by about 6 percent, so less milk would be available for dairy products (table 4), with higher world prices. The average increase in price ranges from 13 percent for nonfat dry milk to 67 percent for butter. In Australia and New Zealand, milk production increases by 7-8 percent and milk producer price by 33-34 percent (table 4).

Scenario 3: Removal of Domestic Support

In this scenario, price support (intervention prices, loan rates, government purchases) and producer payments are eliminated.[7] Production quotas are sometimes used to limit governments' budgetary exposure related to price support. However, the effects on milk production of removing production quotas and price support are different and we try to distinguish the effects of these policies by not removing production quotas in this scenario.

[7]Although production quotas are a form of price support, as indicated in the tables in Appendix B, we separate production quotas from other domestic support measures in order to evaluate their effects on world dairy markets separately from other policies.

For the countries that have price support programs (U.S. and EU), their removal decreases milk production (table 5). Moreover, with less production, exports decline, reducing the need for export subsidies. Milk producer prices decline by 0.2 percent in the United States and 3.1 percent in the EU. With lower world dairy production and less available for export, world dairy prices increase. Overall, the effects of removing price support are small compared with the removal of import restraints and milk production quotas.

Table 4
Effects of eliminating import restrictions[1]

Country	Milk producer price	World price dairy products			Milk producer
		Butter	Cheese	Nonfat	
	Percent change				
US	-11.3	67.2	50.3	12.9	-5.6
EU	-9.3	67.2	50.3	12.9	-3.2
Japan	-7.4	67.2	50.3	12.9	-1.8
Canada	-11.5	67.2	50.3	12.9	-2.9
Mexico	14.2	67.2	50.3	12.9	3.5
Brazil	4.3	67.2	50.3	12.9	1.1
Argentina	27.1	67.2	50.3	12.9	6.3
China	7.4	67.2	50.3	12.9	1.9
Australia	34.1	67.2	50.3	12.9	7.7
New Zealand	33.2	67.2	50.3	12.9	7.5
South Korea	-47.6	67.2	50.3	12.9	-14.8
Rest of world	9.2	67.2	50.3	12.9	2.3

[1] Tariffs, TRQs, import levies.

Table 5
Effects of eliminating milk price support

Country	Milk producer price	Price of dairy products			Milk producer
		Butter	Cheese	Nonfat	
	Percent change				
US	-0.2	0.7	-0.2	-1.1	-0.1
EU	-3.1	-2.5	-3.9	-2.7	-1.1
Japan	0.2	1.3	7.5	1.0	0.1
Canada	0.0	0.0	0.0	0.0	0.0
Mexico	0.8	0.8	0.3	0.1	0.2
Brazil	3.1	0.8	7.4	2.3	0.8
Argentina	1.5	0.9	1.7	2.5	0.4
China	0.5			2.2	0.1
Australia	3.7	1.0	7.4	2.6	0.9
New Zealand	3.2	1.0	8.6	2.6	0.8
South Korea	1.2		7.5	2.4	0.3
Rest of world	2.1	0.8	7.6	2.1	0.5

Scenarios 4 and 5: Global Trade Liberalization

All policy instruments are eliminated in scenarios 4 and 5, the difference being that only dairy policies are liberalized under Scenario 4. For Scenario 5, all policy instruments related to trade for dairy products and other dairy-related commodities, such as feed grains and other livestock, are liberalized.

When all protection related to dairy production and trade is removed, world dairy prices increase (table 6). The impact on world prices is slightly higher when all commodities are liberalized than under dairy-only liberalization. Dairy product prices increase from 13 percent for nonfat dry milk to 66 percent for butter in the dairy-only scenario, and from 14 to 68 percent in the all-commodities scenario (table 6). Butter price increases the most in both scenarios because it receives higher support prior to liberalization. The results indicate that high support levels in subsidizing countries lead to higher production of milk and dairy products than would occur without support. When all support and protection is removed, milk and dairy product production falls and trade declines, resulting in higher world dairy product prices. The slightly higher world prices under full versus dairy-only liberalization are the result of lower feed grain prices in some countries that currently support grain production. Lower feed grain prices would suggest that allocation of the feeds among grain-consuming livestock might result in a marginal decrease in dairy feeding, and thus a decrease in milk production.

With global dairy policy reform, the volume of dairy product trade declines but products are traded at higher prices. The value of trade increases since there is increased market access and demand for dairy products, although less milk and dairy products are produced after liberalization. The volume of dairy product trade (exports plus imports) declines by 660,000 tons (6 percent), with the elimination of export subsidies. Still, dairy trade increases in value by $2.1 billion (11 percent) due to higher world prices in Scenario 4 and by nearly $3 billion in scenario 5, nearly 20 percent above the base (figs. 3 and 4).

The effects of dairy trade liberalization on the U.S. dairy sector are small relative to sales ($60 billion in 2001). Raw milk price declines 11 percent (from the base year) under dairy-only liberalization and 9 percent under all-commodity liberalization (table 7). Raw milk production declines about 6 percent under the dairy-only scenario and 7 percent under the all-commodity scenario. These estimated production changes are slightly greater than most actual year-to-year changes in U.S milk production (fig. 5). Again, the liberalization scenarios do not account for technology changes and productivity growth in the United States, which would likely offset losses to U.S. milk producers.

Table 6
Changes in world market prices of dairy products

	Dairy reform only	All sectors liberalized
	Percent change from base	
Butter	66.4	68.2
Cheese	50.2	54.3
Nonfat dry milk	13.2	14.2
Whole dry milk	24.0	26.4

Figure 3

World dairy trade $2 billion higher after dairy trade liberalization

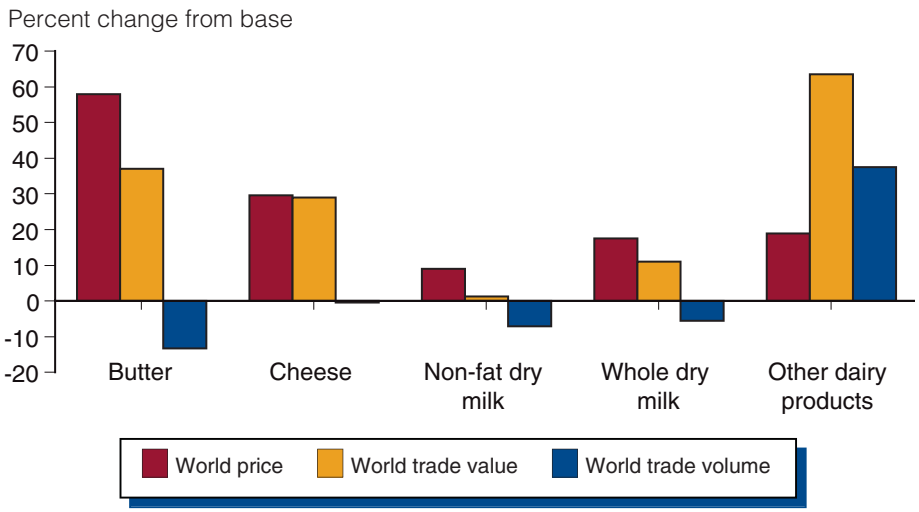
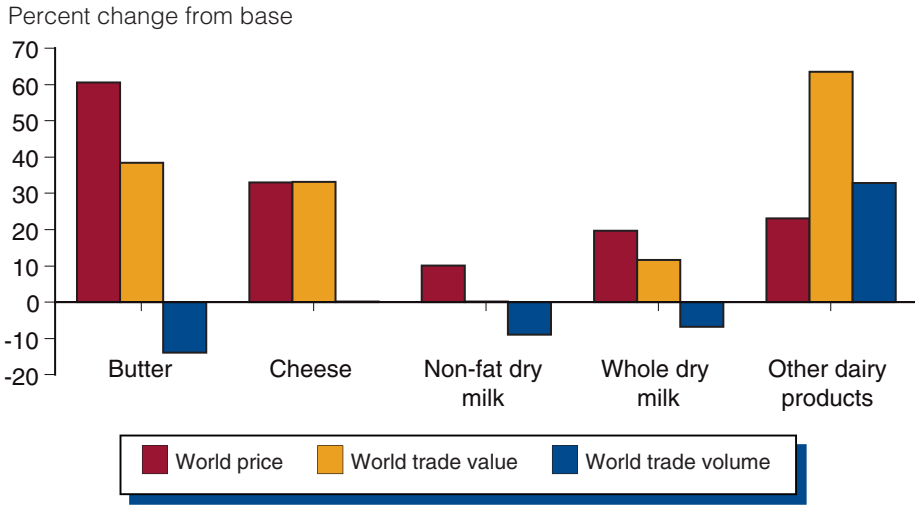


Figure 4

World dairy trade nearly $3 billion higher after full liberalization



Australia and New Zealand—low-cost, nonsubsidized exporters—gain the most from liberalization, with raw milk prices increasing by 33-37 percent from their base and production expanding by 7-8 percent in both scenarios (table 7). These countries' dairy sectors gain from the increases in world dairy prices and from an expanding market for their exports as production declines in other countries.

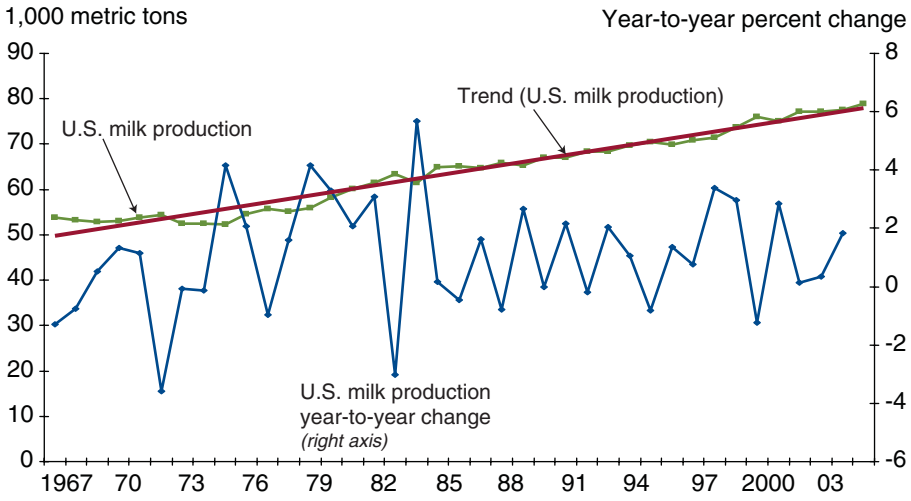
Milk prices decline in the EU by about 9 percent under the dairy-only scenario and 7 percent under the all-commodity scenario (table 7). Milk production falls by more in the all-commodity scenario, despite the smaller reduction in the EU milk price. Lower feed grain prices in the EU have an expansionary effect on the grain-consuming livestock sector at the expense of the dairy sector. Again, with no recent history of milk supply response in the EU (because of the 20-year history of milk production quotas),

Table 7—Changes in milk price, production with trade liberalization

Country	Dairy reform only		All sectors liberalized	
	Milk price	Milk production	Milk price	Milk production
		Percent change		
US	-11.4	-5.7	-8.8	-7.3
EU	-9.4	-3.2	-6.6	-4.3
Japan	-7.4	-1.8	-7.4	-3.1
Canada	-11.5	-2.9	-8.5	-3.4
Mexico	14.2	3.5	20.7	3.9
Brazil	4.2	1.1	8.6	0.7
Argentina	27.1	6.3	31.1	5.5
China	7.3	1.8	10.2	1.9
Australia	34.1	7.7	37.3	7.3
New Zealand	33.2	7.5	35.9	7.4
South Korea	-47.6	-14.8	-46.1	-14.9
Rest of world	9.2	2.3	8.4	2.8

Figure 5

U.S. milk production



researchers disagree on the magnitude of an EU supply elasticity, which, as demonstrated earlier, can significantly influence the levels of dairy production (Appendix B).

The largest effects on dairy markets are under all-commodity reform. Here, world market prices of traded dairy products increase by slightly more than in the dairy-only scenario (table 6). For many countries, declines in dairy production are larger, or increases smaller, than in the dairy-only scenario despite higher world dairy product prices. When all commodities are liberalized, dairy market impacts are influenced not only by changes in milk and dairy product prices, but also by changes in the price of inputs (primarily feed grains) and the prices of commodities that compete for production inputs. For example, the feed cost for U.S. milk production rises more than 11 percent because of higher world grain prices. Consequently, the higher costs for U.S. dairy farmers lead to a larger decline in milk production than under dairy-only liberalization.

Similarly, Canadian dairy producers face higher feed grain prices, and dairy production declines relative to the dairy-only scenario, despite the quota elimination. Feed grain price increases are small in Japan, but result in a slightly higher decline in milk production as well. Australia's and New Zealand's feed costs for milk rise minimally because their production systems are forage-based.

The EU's support systems for grains and other livestock have opposite effects on dairy production. In the base period, EU support and protection for both grains and beef result in domestic market prices that are generally higher than world market prices. As support and protection is cut for EU grains, grain prices in the EU fall, and the EU cost of producing milk declines by 7.5 percent. However, EU beef prices decline by 30 percent as import barriers and domestic supports are eliminated. The EU dairy herd supplies about two-thirds of the EU's beef production, so a decline in beef price reduces the profitability of dairy production and results in a contraction of milk production (European Commission, 2004; Abler and Blandford, 2000). Hence, EU milk output falls by more when all commodities are liberalized, despite a smaller decline in milk price and lower input prices. This result points out the advantage of a multi-commodity model that identifies the interrelationships among various commodities in an across-the-board trade liberalization scenario.

Liberalization of dairy policies results in a realignment of countries' shares of the global dairy market. The EU, the world's largest exporter of dairy products in the base period, sees its share of butter and nonfat dry milk (NFDM) trade decline, but maintains its share of the cheese market (table 8). (EU milk supply shifts from production of butter and NFDM to production of cheese.) New Zealand's and Australia's shares of butter and NFDM exports rise, and Argentina grows in all markets except other dairy products. The United States generally maintains its trade position in most markets, and gains slightly in the NFDM market. Higher world prices allow the United States to increase its share of NFDM exports, particularly as the EU's share declines.

Table 8

Changes in dairy product export shares with dairy only policy reform[1]

	Butter		Nonfat dry milk		Cheese		Other dairy	
Country	Base	Scenario	Base	Scenario	Base	Scenario	Base	Scenario
				Percent change				
US	0.8	0.8	11.8	12.2	2.8	2.2		
EU	16.6	2.1	23.3	17.5	54.1	54.2	28.3	48.5
Japan							2.8	9.8
Canada	1.7	2.0	3.4	3.4	1.9	1.7		
Mexico								
Brazil								
Argentina	1.3	2.3	2.4	2.8	2.3	3.9	27.3	16.3
China								
Australia	22.9	27.5	24.7	27.3	17.0	17.6	41.6	25.2
New Zealand	53.1	61.0	19.9	21.5	18.8	18.9		
South Korea								
Rest of world	3.6	4.3	14.6	15.2	3.1	1.4	0.0	0.1

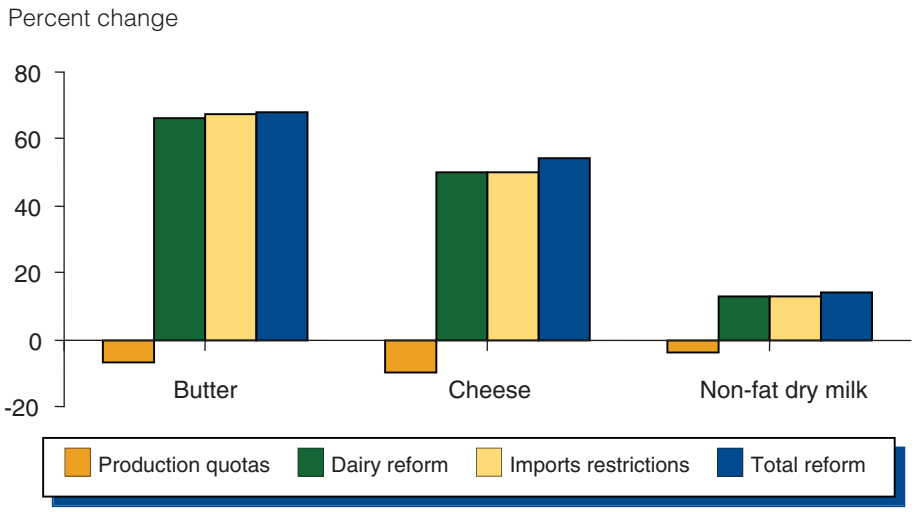
[1] Changes in export shares of whole dry milk are insignificant.

Note: Blank cell indicates no significant share of commodity market.

Comparing global price changes across scenarios indicates that a total liberalization of all commodities accounted for the greatest change (fig. 6). Much of the increase in world dairy prices results from eliminating import restrictions, owing to their high levels in the base year. World prices of butter increase by more than other dairy products due to the higher support that butter received in the base year.

Figure 6

Global prices under trade liberalization



Conclusions

The scenario analyses indicate the direction of changes in key economic variables after simulating changes in dairy policy. Liberalization of world dairy markets—eliminating price support, production quotas, import barriers, and export subsidies—was found to reduce the volume of dairy products traded globally as higher dairy product prices reduced demand. Despite lower trade volumes, the value of dairy product trade increases due to higher prices.

Trade liberalization was found to affect countries differently. Countries with high levels of support and protection (e.g., Japan and Korea) generally lose production value. Lower-cost countries and those with low support and protection (e.g., Australia and New Zealand) gain the most from trade liberalization, as their producers benefit from higher world market prices and their exports grow. The effect on countries with moderate support and protection, like the United States, the EU, and Canada, depends on the policy mix in each country. The effect of price declines on production in the EU and Canada is offset by the removal of production quotas. Declines in milk price lead to reductions in U.S. milk production. However, productivity growth in milk production of 1 percent per year would offset any losses to U.S. milk producers.

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Appendix A—Dairy Policies of Selected Countries

United States

Commodity	Production	Export market share	Domestic support: Income support: Direct and countercyclical payments	Domestic support: Income support: Disaster aid	Domestic support: Price support: Government purchases	Domestic support: Other: Marketing orders	Trade policies: Market access: Import quotas (TRQs)	Trade policies: Market access: Tariffs	Trade policies: Export competition: Export subsidies
	1,000 metric tons								
Milk	77,002	19.6[1]	X	X		X			
Butter	615	0.4			X		X	X	X
Cheese	3,906	4.7			X		X	X	X
Nonfat dry milk	712	12.3			X		X	X	X
Whole dry milk	21	na					X	X	
Other dairy products							X	X	

[1] World production share.
na = Not available.

Source: USDA PSD 2002 data.

European Union

Commodity	Production	Market share	Domestic support: Price support: Supply management	Domestic support: Price support: Intervention	Domestic support: Price support: Other storage aid	Domestic support: Other: Consumer subsidies	Trade policies: Market access: Tariffs	Trade policies: Market access: Import quotas (TRQs)	Trade policies: Export competition: Export subsidies
	1,000 metric tons								
Milk	115,130	29.3[1]	X			X			
Butter	1,792	28.4		X	X	X	X	X	X
Cheese	5,470	41.0			X		X	X	X
Nonfat dry milk	1,070	15.7		X	X	X	X	X	X
Whole dry milk	800	34.4					X	X	X
Other dairy products							X	X	X

[1] World production share.

Source: USDA PSD 2002 data.

Canada

Commodity	Production	Export market share	Domestic support: Import support: Disaster aid	Domestic support: Price support: Supply management	Domestic support: Price support: Support price	Trade policies: Market access: Tariffs	Trade policies: Market access: Import quotas (TRQs)	Trade policies: Export competition: Export subsidies
	1,000 metric tons							
Milk	7,964	2.0[1]	X	X	X			
Butter	76	2.3			X	X	X	X
Cheese	335	1.5				X	X	X
Nonfat dry milk	81	4.8			X	X	X	X
Whole dry milk	na	na				X	X	
Other dairy products						X	X	X

[1] World production share.
na = Not available.

Source: USDA PSD 2002 data.

Australia/New Zealand

Commodity	Production	Market share Australia/ New Zealand	Domestic support	Trade policies	
			Import support	Market access	
			Producer payments	Tariffs	Import quotas (TRQs)
	1,000 metric tons				
Milk	11,608 /13,925	3 /3.5[1]			
Butter	164 /370	16.7 /45.8		X	X
Cheese	413 /312	19.6 /24.9		X	X
Nonfat dry milk	261 /255	22.6 /24.2			
Whole dry milk	239 /540	14.9 /36.7			
Other dairy products					

[1] World production share.

Source: USDA PSD 2002 data.

Japan

Commodity	Production	Import market share	Domestic support			Trade policies	
			Import support	Price support	Other	Market access	
			Producer payments	Production quotas	Consumer subsidies	Tariffs	Import quotas (TRQs)
	1,000 metric tons						
Milk	8,385	2.1	X [1]	X [1]	X		
Butter	88	0.5				X	X
Cheese	34	18.3				X	X
Nonfat dry milk	180	4.3				X	X
Whole dry milk	na					X	X
Other dairy products							

[1] Only for milk for the purpose of manufacturing butter and milk powder, not for drinking milk.

na = Not available.

Source: USDA PSD 2002 data.

Appendix B—Dairy Product Elasticities

Country	Butter	Nonfat dry milk	Cheese	Fluid milk	Whole dry milk	Other dairy products
United States						
Butter	1.66	1.69	-1.52	-1.50	-0.03	-0.30
Nonfat dry milk	1.66	1.69	-1.52	-1.50	-0.03	-0.30
Cheese	-0.32	-0.33	2.47	-1.50	-0.03	-0.30
Fluid milk	-0.32	-0.33	-1.52	2.49	-0.03	-0.30
Whole dry milk	-0.32	-0.33	-1.52	-1.50	3.69	-0.30
Other dairy products	-0.32	-0.33	-1.52	-1.50	-0.03	3.69
European Union						
Butter	0.40	0.52	-0.51	-0.32	-0.09	0.00
Nonfat dry milk	0.40	0.52	-0.51	-0.32	-0.09	0.00
Cheese	-0.18	-0.23	0.82	-0.32	-0.09	0.00
Fluid milk	-0.18	-0.23	-0.51	1.01	-0.09	0.00
Whole dry milk	-0.18	-0.23	-0.51	-0.32	1.24	0.00
Other dairy products	-0.18	-0.23	-0.51	-0.32	-0.09	1.33
Japan						
Butter	0.40	0.63	-0.04	-0.78		-0.20
Nonfat dry milk	0.40	0.63	-0.04	-0.78		-0.20
Cheese	-0.12	-0.18	1.29	-0.78		-0.20
Fluid milk	-0.12	-0.18	-0.04	0.55		-0.20
Whole dry milk	-0.12	-0.18	-0.04	-0.78		1.13
Other dairy products						
Canada						
Butter	0.35	0.67	-0.43	-0.46	0.00	-0.14
Nonfat dry milk	0.35	0.67	-0.43	-0.46	0.00	-0.14
Cheese	-0.10	-0.20	0.90	-0.46	0.00	-0.14
Fluid milk	-0.10	-0.20	-0.43	0.87	0.00	-0.14
Whole dry milk	-0.10	-0.20	-0.43	-0.46	1.33	-0.14
Other dairy products	-0.10	-0.20	-0.43	-0.46	0.00	1.19
Mexico						
Butter	0.44	0.84	-0.16	-0.55		-0.57
Nonfat dry milk	0.44	0.84	-0.16	-0.55		-0.57
Cheese	-0.02	-0.03	1.17	-0.55		-0.57
Fluid milk	-0.02	-0.03	-0.16	0.78		-0.57
Whole dry milk						
Other dairy products	-0.02	-0.03	-0.16	-0.55		0.76
Brazil						
Butter	0.42	0.81	-0.21	-0.79	-0.11	-0.13
Nonfat dry milk	0.42	0.81	-0.21	-0.79	-0.11	-0.13
Cheese	-0.03	-0.06	1.12	-0.79	-0.11	-0.13
Fluid milk	-0.03	-0.06	-0.21	0.54	-0.11	-0.13
Whole dry milk	-0.03	-0.06	-0.21	-0.79	1.22	-0.13
Other dairy products	-0.03	-0.06	-0.21	-0.79	-0.11	1.20
Argentina						
Butter	0.41	0.78	-0.46	-0.31	-0.22	-0.19
Nonfat dry milk	0.41	0.78	-0.46	-0.31	-0.22	-0.19
Cheese	-0.05	-0.10	0.87	-0.31	-0.22	-0.19
Fluid milk	-0.05	-0.10	-0.46	1.02	-0.22	-0.19
Whole dry milk	-0.05	-0.10	-0.46	-0.31	1.11	-0.19
Other dairy products	-0.05	-0.10	-0.46	-0.31	-0.22	1.14

Appendix B—Dairy Product Elasticities, continued

Country	Butter	Nonfat dry milk	Cheese	Fluid milk	Whole dry milk	Other dairy products
China						
Butter						
Nonfat dry milk						
Cheese						
Fluid milk				0.86	-0.49	-0.37
Whole dry milk				-0.47	0.84	-0.37
Other dairy products				-0.47	-0.49	0.96
Australia						
Butter	0.30	0.57	-0.33	-0.26	-0.13	-0.14
Nonfat dry milk	0.30	0.57	-0.33	-0.26	-0.13	-0.14
Cheese	-0.16	-0.30	1.00	-0.26	-0.13	-0.14
Fluid milk	-0.16	-0.30	-0.33	1.07	-0.13	-0.14
Whole dry milk	-0.16	-0.30	-0.33	-0.26	1.20	-0.14
Other dairy products	-0.16	-0.30	-0.33	-0.26	-0.13	1.19
New Zealand						
Butter	0.20	0.39	-0.21	-0.04	-0.30	-0.04
Nonfat dry milk	0.20	0.39	-0.21	-0.04	-0.30	-0.04
Cheese	-0.26	-0.49	1.12	-0.04	-0.30	-0.04
Fluid milk	-0.26	-0.49	-0.21	1.29	-0.30	-0.04
Whole dry milk	-0.26	-0.49	-0.21	-0.04	1.03	-0.04
Other dairy products	-0.26	-0.49	-0.21	-0.04	-0.30	1.29
South Korea						
Butter						
Nonfat dry milk						
Cheese			1.28	-0.92		-0.36
Fluid milk			-0.05	0.41		-0.36
Whole dry milk						
Other dairy products			-0.05	-0.92		0.97
Rest of world						
Butter	0.26	0.64	-0.08	-0.55	-0.02	-0.25
Nonfat dry milk	0.26	0.64	-0.08	-0.55	-0.02	-0.25
Cheese	-0.13	-0.31	1.25	-0.55	-0.02	-0.25
Fluid milk	-0.13	-0.31	-0.08	0.78	-0.02	-0.25
Whole dry milk	-0.13	-0.31	-0.08	-0.55	1.31	-0.25
Other dairy products	-0.13	-0.31	-0.08	-0.55	-0.02	1.08

Source: Stout and Abler. ERS/Penn State Trade Model Documentation, table 18.